Review on the Relationship of Social Capital, Absorptive capacity and Technology Transfer Performance: a Conceptual Framework

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Abstract. The success of technology transfer often depends on many factors. The soft aspects of technology, such as knowledge, skills, and organization, are the critical aspects for the successful transfer of technology. Tacit knowledge and personal experience of an individual can only be obtained in a tacit manner. Therefore social interaction and absorptive capacity are very important to facilitate technological knowledge transfer among the units within an organization. This paper aims to contribute to the existing knowledge in the field of technology transfer by exploring absorptive capacity and an important factor of absorptive capacity that is social capital which may enhance the firms absorptive capacity and technology transfer performance. A conceptual framework synthesized from a review of the literature is presented. The links between variables are viewed by the proposed model.

Keywords: Technology transfer performance, absorptive capacity, social capital.

1. Introduction

In the fast-changing competitive environment, technological innovation has become more important due to quick appearance of similar or substitute technology, short technology product life cycle, and globalization. For a business firm, there are two ways to obtain technology, self-R&D and technology transfer [1]. Self-R&D strategy is a good option in creating the firms own innovation such as patents and processes. However, it can only be done if the firms have sufficient technology capabilities and finances. It is time consuming, expensive, and risky as it is impossible to take back the efforts in case of failure.

According to Li-Hua and Khalil [2] technology is an expression of human creativity and depends on harnessing information into knowledge and applying this knowledge to the betterment of human conditions. It is a combination of "hardware" (buildings, plant and equipment), "software" (the way to operate the hardware) and "know-how" (skills, knowledge and experience together with suitable organisational and institutional arrangement). It is highlighted in their study that in understanding the concept of technology, four inter-link elements should be considered are technique, knowledge (normally being considered as "technology" upon its application), the organisation of the production and the product [2]. They also noted that 'knowledge' is the key to control technology as a whole. When the technological product is transferred, the knowledge of its composition, use and application are also transferred. This approach shows that technology and knowledge transfer are not separable.

Technology transfer is an alternative way to improve and adopt technologies from others. The technology to be transferred can be included as intangible assets which do not have specific form that has economic value for example in a narrow sense it can be manufacturing site, manufacturing method, confidential skill and know how or in the wider sense it means the entire intellectual property [1]. Technology transfer is not a new thing and research in technology transfer has been conducted from various perspectives. The mainstream of the existing literature on technology transfer is concerned

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solely with inter firm diffusion while intra-firm diffusion has been largely ignored although it is important [3]. This paper aims to contribute to redress that balance by presenting a new approach to modelling intra-firm diffusion. It discusses on the technology transfer performance and focuses on the important firm-specific assets which are absorptive capacity and social capital.

2. Review and Framework

2.1. Technology Transfer Performance

Transferring technology is more complicated and specialized than transferring of general goods and there are greater possibilities to enhance professional services and business opportunities. Technology transfer implies to express different meanings to different people and different organisations[4]. Conventionally, technology transfer was conceptualised as the transfer of hardware objects, but in the present day it often involves information (e.g. a computer software program or a new idea) that may be completely devoid of any hardware aspects.

Technology transfer encompasses the movement of physical structure, knowledge, skills, organization, values, and capital from the site of generation to the receiving site [5]. A firm's ability to achieve its goal or objective is an indication of technology transfer performance and success [6]. According to Rose et al. [7] technology transfer success includes the ability to learn, acquire, absorb and apply new external technologies and knowledge embedded in product materials, physical assets, processes and production, and management capabilities and not limited to possessing the ability to operate, maintain or repair the machineries in the production level. Three common objectives that firms hope to achieve through technology transfer are the introduction of new techniques, the improvement of new techniques and the generation of new knowledge [4].

The unseen aspects of technology, such as knowledge, skills, and organization, might be much more critical than the physical aspects for the successful transfer of technology[3] [8]. Soft technology has been studied in diverse discipline; science, economic, sociology, anthropology and management [9]. Numerous studies for example Foss and Pedersen [10], Noor [1], and Sarif and Ismail [11] have looked at the soft technology transfer. These transfer processes have otherwise been labelled as intra-unit knowledge sharing or subsidiary inflow or outflow [9] [12].

A series of papers have presented measures for the performance of technology transfer. Most of these measures have the form of new constructs, such as "degree of knowledge transfer" [13], "effectiveness of transfer projects" [14], "inward knowledge transfer" [15], "scope and diversity of intra-network knowledge sharing" [16]. These constructs are operationalized either as combinations of individual items or based on the subjective appreciations of managers involved in the transfer processes.

On the other hand, there are also objective measures for transfer effectiveness. Szulanski et al. [17] have used "accuracy of reproduction" as their dependent variable. Ambos and Schlegelmilch [18] have measured R&D performance directly at each international unit in obtaining number of patents per annum. While the measures mentioned above focus on the results of soft technology transfer, others have looked at the process for example, for the lack of the better name "tacitness" and "knowledge ambiguity" has been dubbed as difficulty of transfer. The most widely used term, is Von Hippel's [19] metaphor of "stickiness" [20] [21]. On the individual level of the expatriate manager, Minbaeva [13] has used "ability and willingness to transfer" as their dependent variable.

These multiple research lenses have produced mixed results. Therefore, any attempt to move forward in the field of soft technology transfer have to endeavour for making the underlying assumptions as clear as possible in order to construct a coherent framework. Technology must be applied and maintained, which implies a demand for a further input of a suitable range of human resources and skills [2].

The employees within firms play important role to yield optimal benefit of technology transfer. According to Davenport and Prusak [22], these roles are fulfilled by the ability to operate, learn, acquire, absorb and apply new external technologies and knowledge embedded in product materials to

maintain and sustain high level of production. As technology transfer involves the process of transmission and absorption of knowledge, the recipient firm's ability to absorb the knowledge transferred is depended on the degree of their absorptive capacity [23] and the internal social capital of the firm.

2.2. Absorptive Capacity

The importance of absorptive capacity has been noticed across the fields of strategic management [28], technology management and international business [24], but few have captured and discussed the richness and multidimensionality of absorptive capacity [4][25]. According to Leonard-Barton [26], starting in the late 1980s, much research attention has been directed to the processes of learning and knowledge transfer, especially in the context of technology transfer projects. Both streams of literature, on technology transfer and organisational learning, increasingly recognise and provide empirical evidence of the unintended (i.e., spill over) benefits that are achieved through learning activities performed by the recipient firm during a technology transfer projects. The important intangible benefits are primarily of the learning type, how to transfer knowledge across alliances and to locate the firm in its capability of enhancing network positions [27] [28].

Davenport and Prusak [25] stated that the knowledge process consists of transmission and absorption, culminating in a behavioural change by the recipient. They considered lack of absorptive capacity in the recipient as friction, which slows or prevents technology transfer. The success of organisational learning is depended on the firm's absorptive capacity, which itself is determined by the firm's prior related knowledge [29]. This prior related knowledge confers to the recipient's ability to recognise the value of new knowledge, assimilate, and apply to commercial ends [22]. This ability was labelled as absorptive capacity by Cohen and Levinthal [30]. In many instances, knowledge sharing and transfer within the company were mainly through informal discussions. Although newsletters were used to share information and insightful experiences, lesson learned from previous projects were not properly documented for future references. Some companies failed to have systematic procedure for documenting lessons from past projects [27]. In technology transfer projects, the recipient organisation is essentially a learning system and technology transfer is a learning process that results in intended and unintended benefits.

Absorptive capacity of a firm is primarily a function of the recipient firm's level of prior related knowledge [25]. Prior related knowledge is closely related to the individuals units of knowledge available within the organisations. Prior related knowledge which includes basic or minimal skills, a shared language, positive attitude towards learning, relevant prior experience and up-to-date information on knowledge domain, is critical for an organisation to assimilate and exploit new knowledge [27][17]. Based on this notion, an organisation's absorptive capacity does not simply depend on the organisation's direct interface with the external environment, but on the transfer of technology (i.e., knowledge, skills and tools) across and within sub-organisations [30].

Minbaeva et al. [16] indicated that absorptive capacity is measured via the employees' ability and motivation. To measure the employees' ability, the critical variables included are performance appraisal and employees' training. Performance appraisal systems provide employees with feedback on their performance and competencies to meet the needs of the firm. An integrated part of most performance appraisal systems is also the establishment of firm's objectives and targets for the self-development and training of employees. Knowledge, skills and tools could be transferred and shared among employees and extensive intra-organisational communication is likely to contribute to employees' motivation.

Most studies focus on absorptive capacity which provides evidence that R&D could generate new knowledge for firms, enhances its ability to assimilate and exploiting existing knowledge [31]. Cohen and Lavinthal [30] argued that R&D provides a spill over benefit, which consist of enhancing the firm's ability to learn from external sources of knowledge and, subsequently create new knowledge. Nevertheless, some industries failed to manage sufficient resources (time and people) in an attempt to improve some of their existing technology for the fact that the employees were too busy with their

current and required tasks. In normal circumstances, employees had very little time to learn new technology other than what was needed to perform their immediate jobs [27].

To acquire a successful technology transfer in any organisation, it is important to consider the level of absorptive capacity and technological capabilities, the competency of local stakeholders/practitioners, the organisational and managerial cultures, the role and structure, the needs and expectation of the organisations itself. In considering of these variables, a further empirical research is needed. Thus, to understand the sources of a firm's absorptive capacity, this study attempts to investigate the critical elements of absorptive capacity in technology transfer projects based on the different models across the globe. Researchers have investigated how managers may develop absorptive capacity by building internal knowledge stocks, but few have focused on the distribution of this knowledge within the firm [32].

2.3. Social Capital

Social interaction is essential to assist in gaining tacit knowledge and personal experience on an individual. Social capital is the prominent concept that provides a foundation to describe and characterize the properties. Social capital is the product of social interactions [33]. According to Putnam [34], social capital is conceptualised as the network of associations, activities or relations that bind people together as a community via certain norms and psychological capabilities, notably trust, which are essential for civil society and productive of future collective action or goods. This implying that the creation of social capital influenced by social abilities, i.e. social competence [35].

In a broader sense, social capital is not a one-dimensional concept [34]. Clarifying the dimensions of social capital is a top priority because social capital has many complicated attributes related to a social context. It encompasses many aspects of a social context, such as social ties, trusting relations, and value systems that facilitate actions of individuals [36]. Nahapiet and Ghoshal [37] propose three dimensions of social capital which are structural, relational, and cognitive aspects. This three-dimensional framework has been employed to investigate the relationship between social capital and intra-organisational phenomena, such as creation of intellectual capital [37], inter-unit resource exchange [36], and organisational citizenship behaviour [38].

The relational view of the firm posits that an organization's level of social capital, or more specifically its network of relationships, is an important determinant of the absorption of technological knowledge. The number and quality of relationships that an organization develops in part determines the frequency at which it is exposed to technological understanding, which in turn affects the efficiency of its innovative behaviours[39]. This is due to the fact that "different network positions represent different opportunities for a unit to access new knowledge that is critical to developing new products or innovative ideas. An organizational unit's network position reveals its ability to access external information and knowledge. Such resources will fuel the unit's innovative activities by providing the external information necessary to generate new ideas" [39].

According to Rahmani and Mousavi, [40] researchers have differentiated between "internal" social capital that examines the "closure" or "bonding" that creates internal cohesiveness and "external" social capital that examines "brokerage" or "bridging" linkages to external groups [41] [34]. Nahapiet & Ghoshal's [37] dimensions of internal social capital: since it offers a more comprehensive picture of social capital in our opinion and identifies a number of factors affecting the internal social capital divided into three dimensions: structural, relational, and cognitive. The structural dimension of social capital describes the configuration of linkages between people within an organization; the relational dimension of social capital "describes the kind of personal relationships people have developed with each other through a history of interactions" and the cognitive dimension refers to those "resources providing shared representations, interpretations, and systems of meaning" [42].

Organizational context is a concept borrowed from the strategy process literature [43], and it can be defined as the set of administrative and social mechanisms of influence-over which top management has direct or indirect control- that shape the behaviours, motivations and attitudes of

employees [44] [45]. The organizational context is a term employed by Bartlett and Ghoshal [46] to refer to fact that some organizations manage to instill in their employees a high level of emotional commitment and enthusiasm beyond that justified by employment practices alone. The organizational context aims to alter not only the behaviours of individuals, but also their motivational and attitudinal state [43] [46].

Social capital is the factor that helps the firms "get through the door, while the firm's social abilities determine the outcome of that interaction [23]. Nahapiet and Ghoshal [28] argued that social capital facilitated the creation of new intellectual capital, which in turn led to the creation and exchange of new knowledge. The central idea of social capital is that a person's relationships, irrespective of their nature, may provide that person with resources that might be valuable to the firms [29]. In this paper, social capital is viewed as a phenomenon existing in all social relationships a person possesses, no matter if the connections are direct and indirect. The following definition encompasses this view and is used in this study to define social capital. Social capital is: "... the sum of the actual and potential resources embedded within, available through and derived from the network of relationships possessed by an individual or social unit" [29]. Thus, it is likely that the development of a network of strong social relationships will help to promote higher levels of experimental learning, since this technological knowledge is possessed within the boundaries of the firm. Social capital also provides firms with an expanded number of learning opportunities, since these firms have a greater number of relationships from which to learn.

This study define social capital as the combined of resources embedded within, available through, and derived from the network of relationships possessed by an individual or organization [37] [49]. Within this view, the central intention of social capital is network of relationships which are valuable resource for the individual or organization. For successful transfer of tacit knowledge between network members, individual social capital must be developed, because the transfer normally requires intimate personal interactions. Nevertheless, the introduction of social capital variables into the analysis of networks and knowledge transfer adds a level of complexity, that has not yet been examined empirically [49].

3. Conceptual Framework

The success of technology transfer often depends on many factors. The soft aspects of technology, such as knowledge, skills, and organization, are the critical aspects for the successful transfer of technology. Tacit knowledge and personal experience of an individual can only be obtained in a tacit manner. Therefore social interaction and absorptive capacity are very important to facilitate technological knowledge transfer within an organization. Accordingly, it is proposed that:

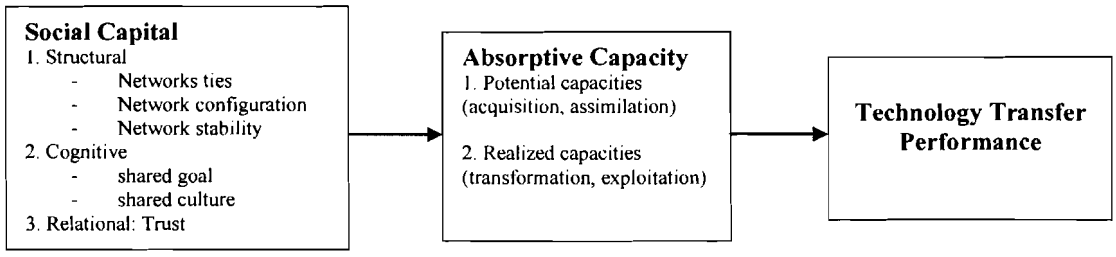

Figure 1: Proposed framework

4. Conclusion

The proposed framework has laid the groundwork to address the internal factors which have an impact on technology transfer performance. It advances our knowledge about how social capitals' creation in

an organization may influence the absorptive capacity and technology transfer performance. Various managerial implications can be derived from the proposed conceptual framework. The proposed framework not only serves as a guiding foundation for future work on the role of absorptive capacity on the technology transfer but also contributes new perspectives to current stream of work on social capital by illustrating organizational context and managerial behavior as key organizational attributes to facilitate the creation of internal social capital in the firm.

However, these are rather general statements and should not be seen as normative suggestions. Instead, firms should aim at breaking out of these normal tracks and find ways to enhance their capacity to absorb knowledge. One primary limitation of the approach is that, apart from review of literature and anecdotal evidence, the paper do not offer a rigorous examination of the propositions put forth in this paper. Clearly, there is need for empirical research and the proposed model yet needed to be proved by gathering data.

5. References

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